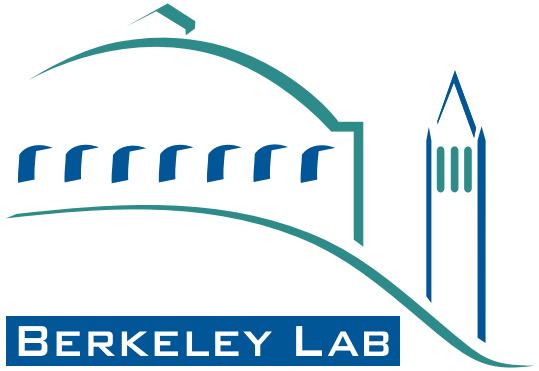

Stability measurements of thin foils for RF cavities for the cooling channel

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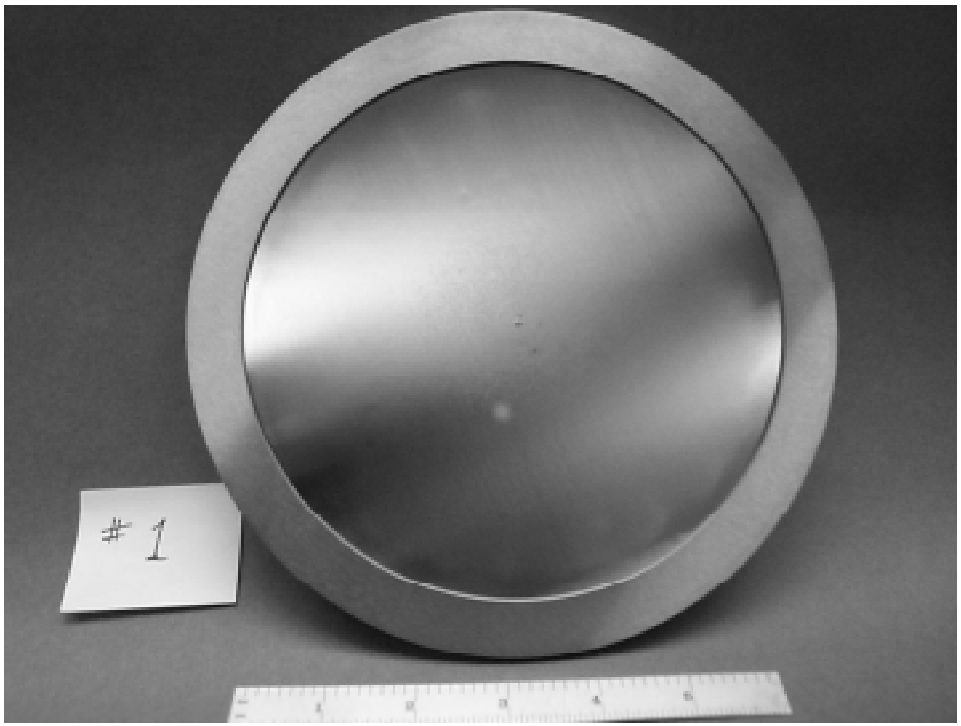
LBNL

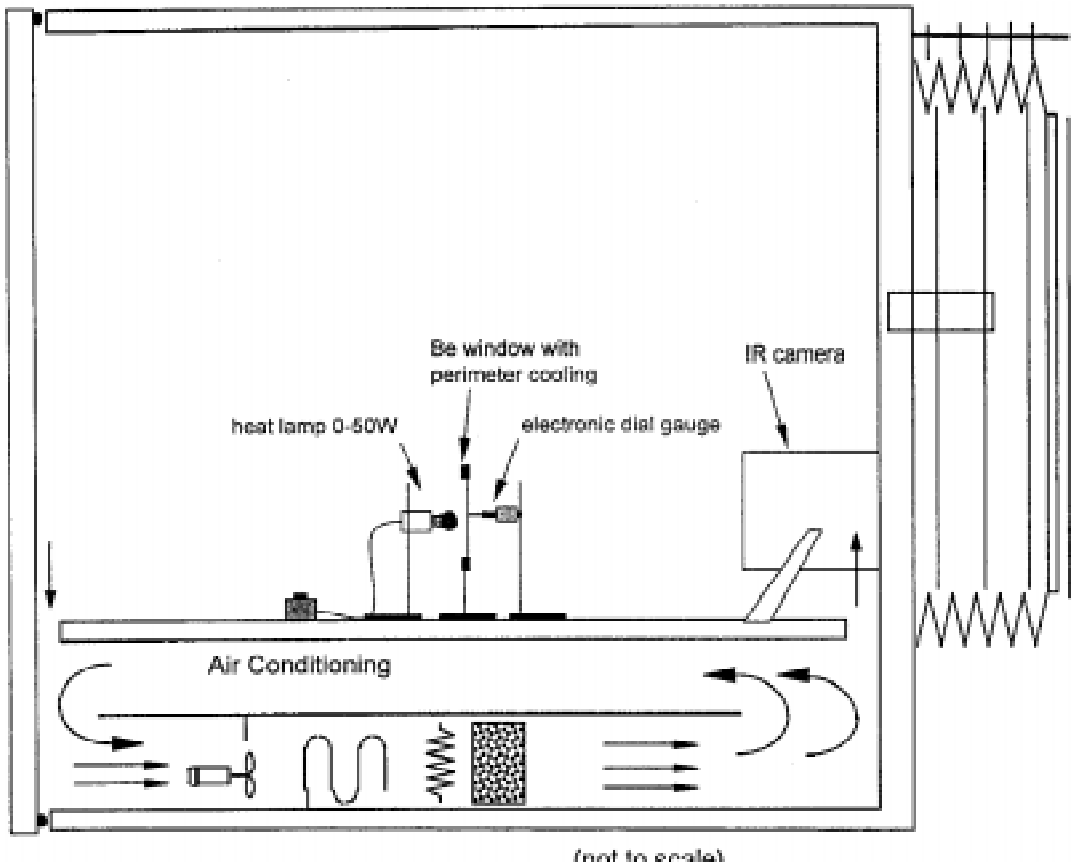
RF windows for 805 MHz cavities

- Be foils 0.005” thick
- 99.8% Be
- Foil diffusion bonded to Be frame
  - 0.063” thick rings
  - 6.3” internal diameter
  - 7.58” outside diameter
- Foil flatness 0.001”
- Pre-stressed

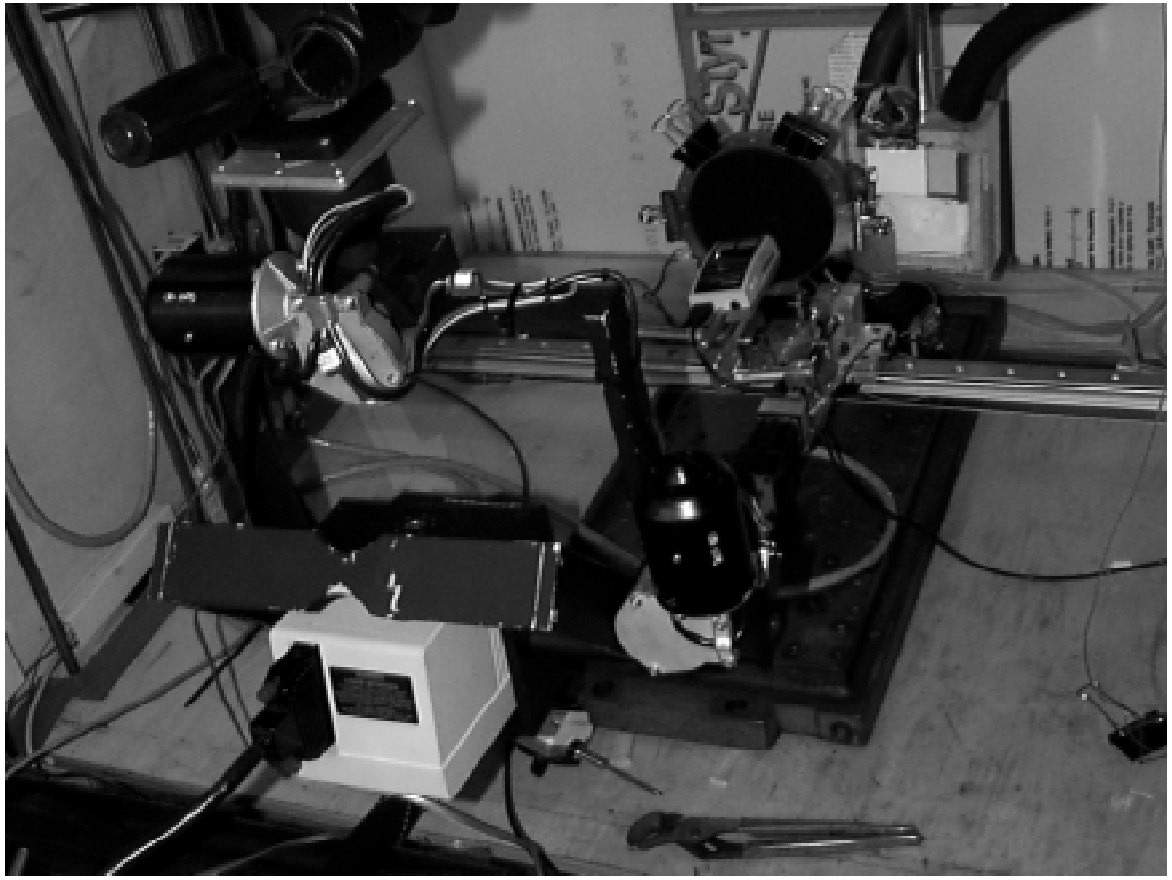


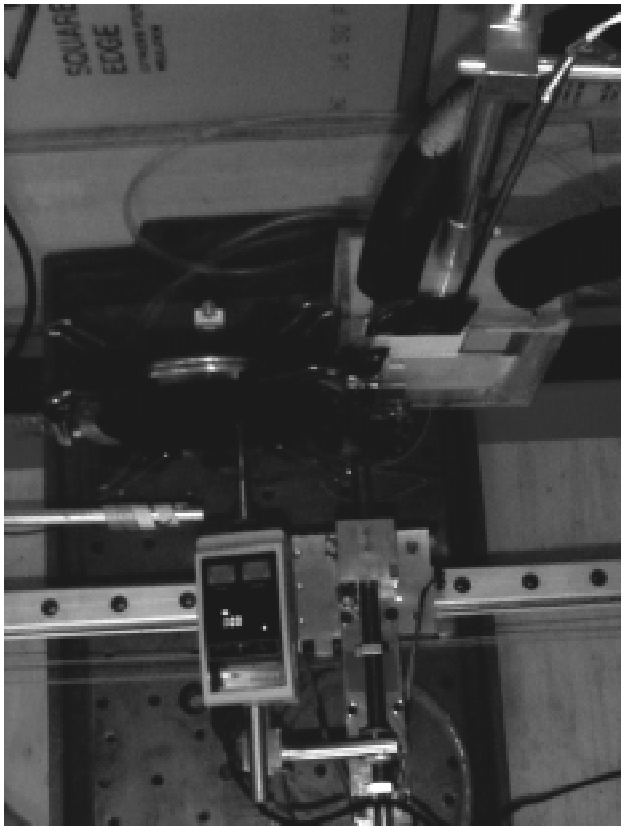
Experimental setup

- Window frame cooled with water (room temperature)
- Radiative heating with halogen lamp
- Measure temperature distribution with thermal camera
- Measure deflection with dial gauge
  - Al, Cu, Be foils measured



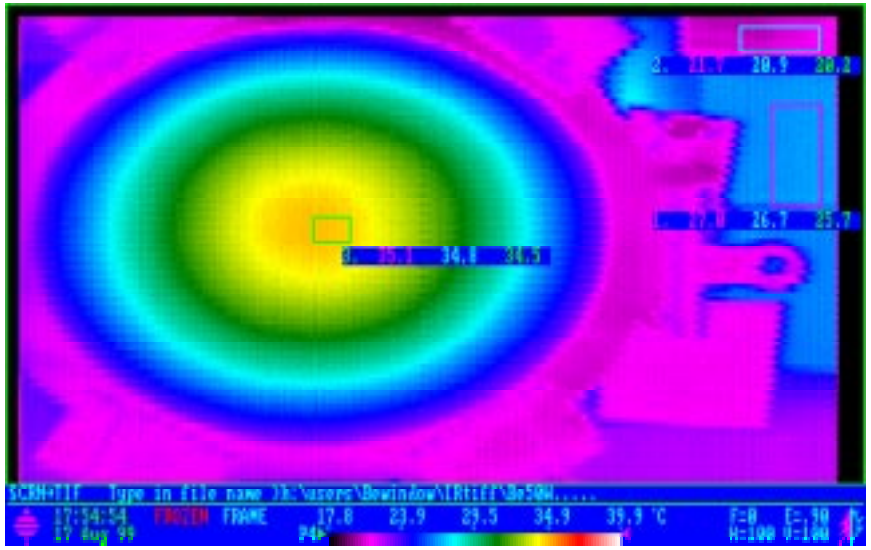
Experimental arrangement

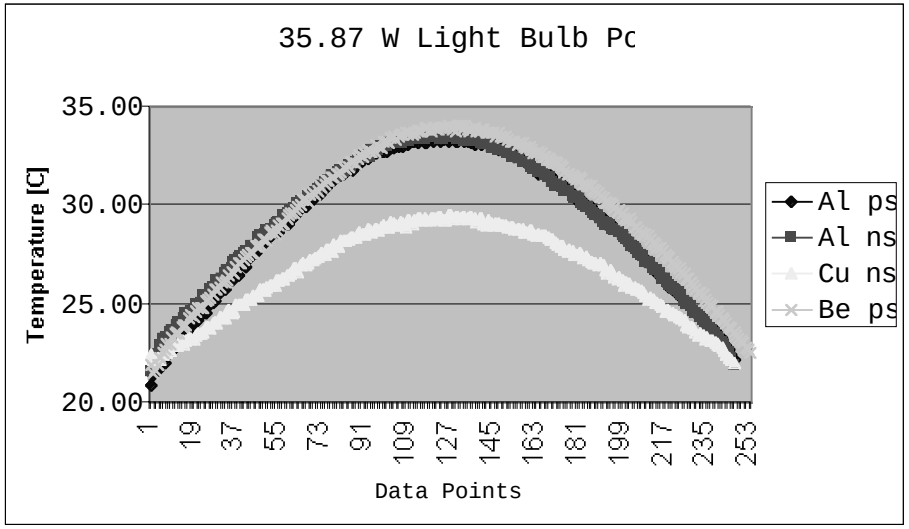




Temperature low-power (36 W)

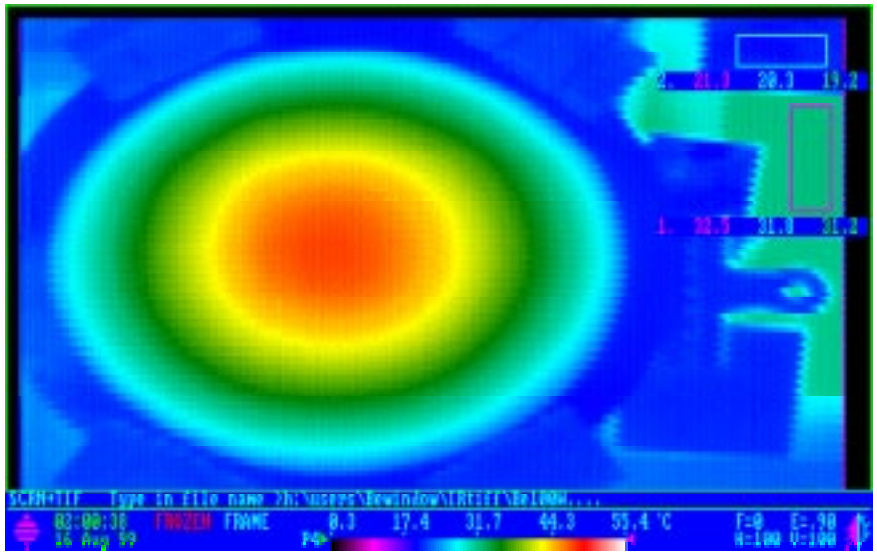
- Thermal image
  - Be foil
- Scanned temperatures
  - Al, Cu, Be

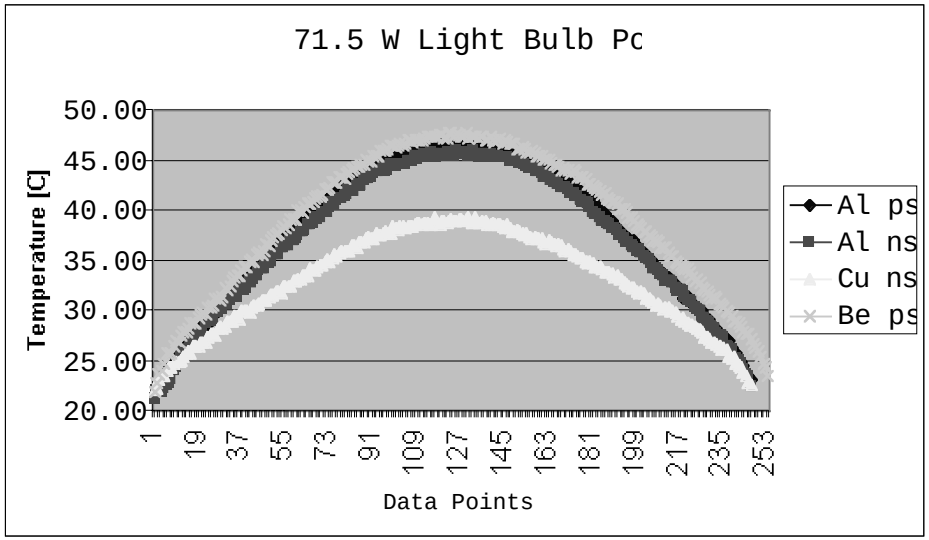




Temperature high-power (71 W)

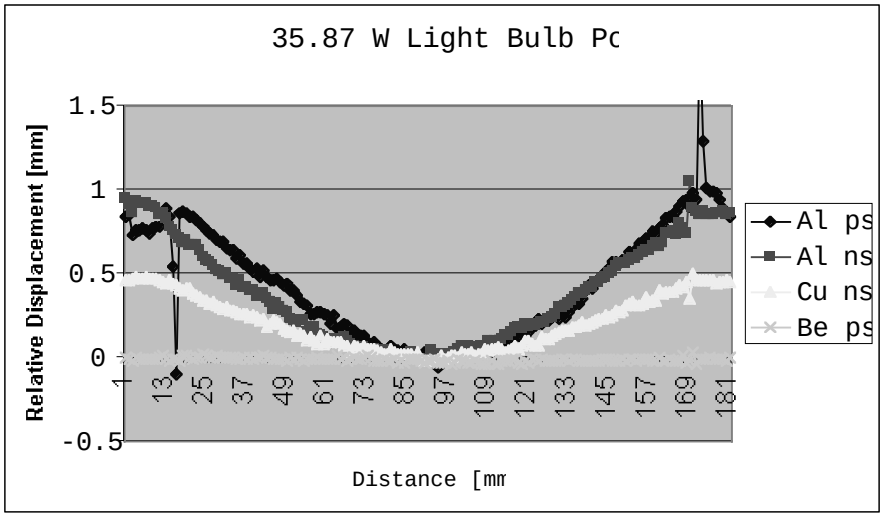
- Thermal image
  - Be foil
- Scanned temperatures
  - Al, Cu, Be



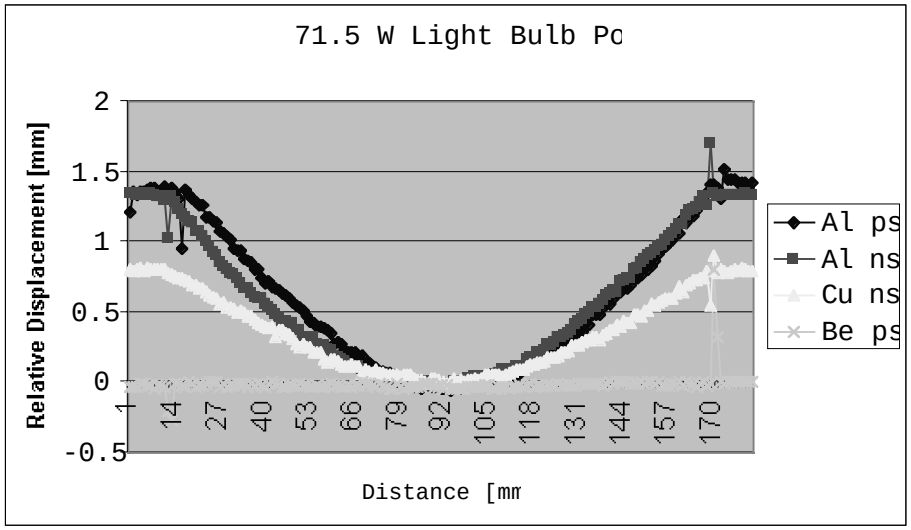


Displacement

- Low power



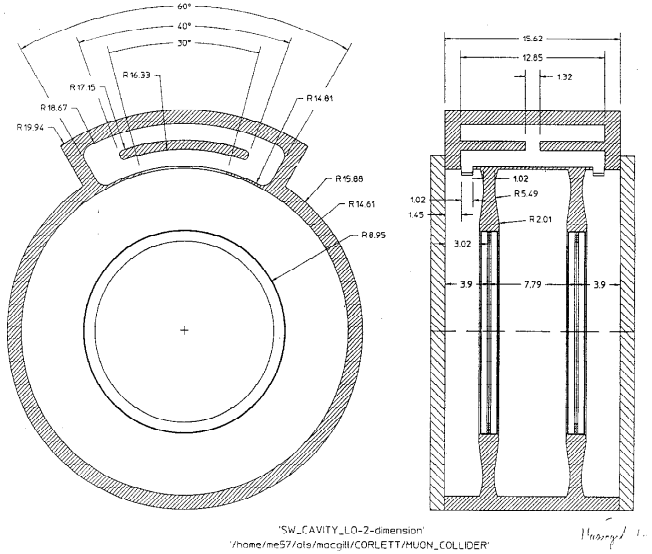
- High power

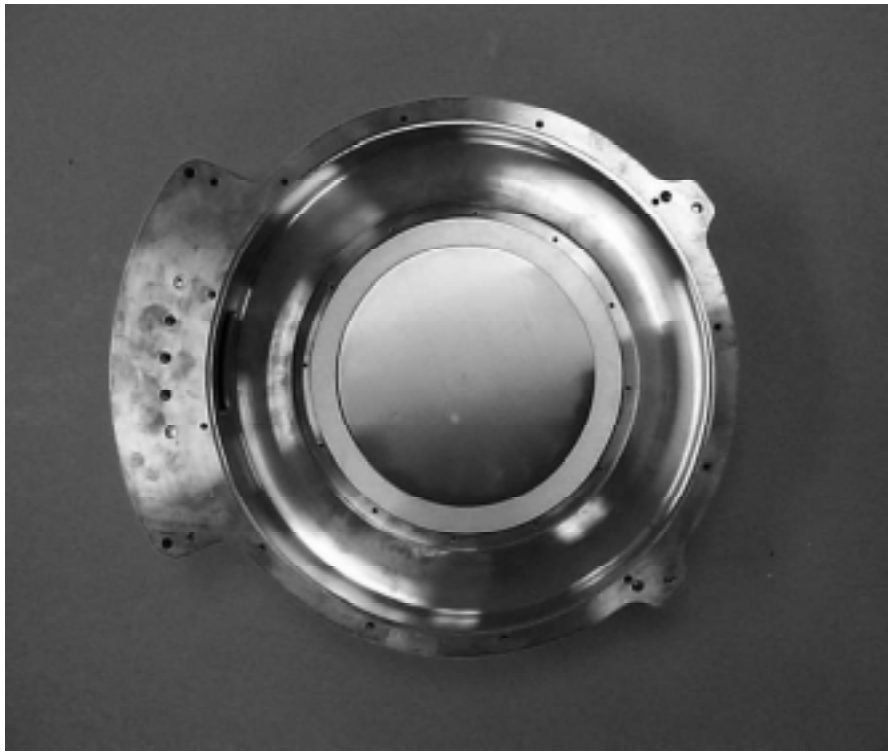


  - No movement in Be foil

Low-power test cavity

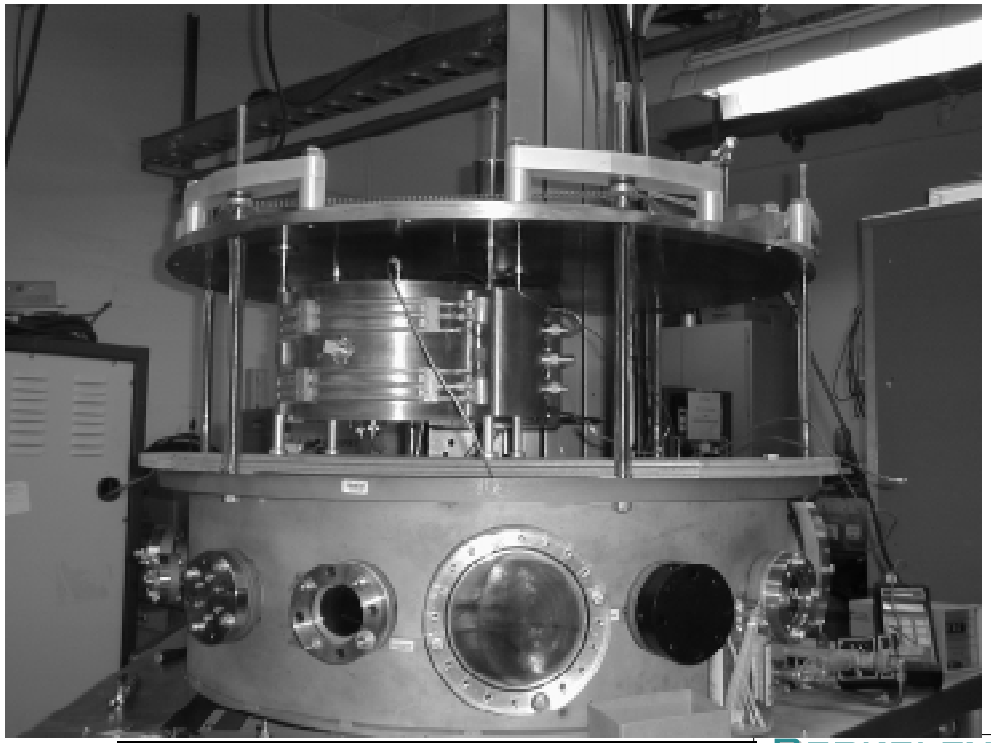
- Test Be windows
  - Mechanical stability
    - RF fields
    - Low temperature

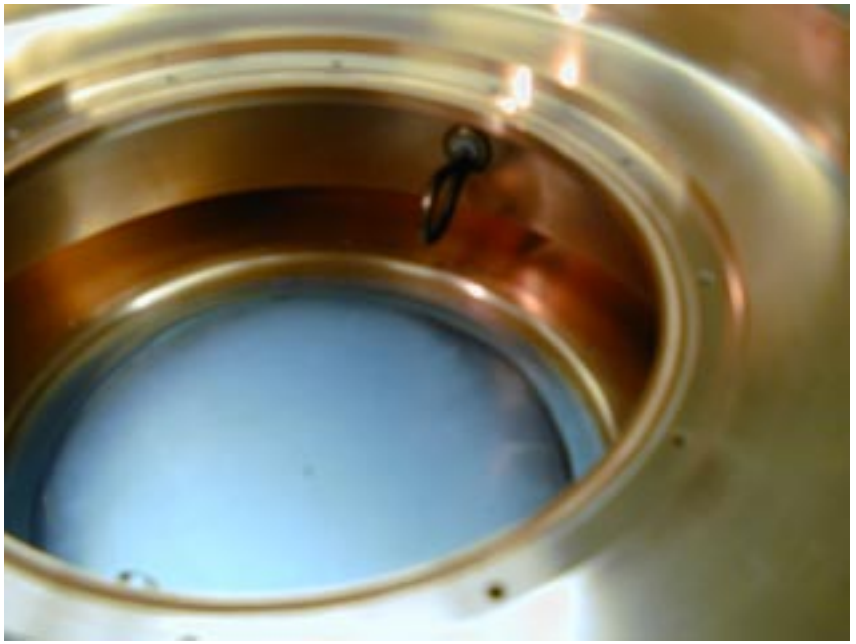


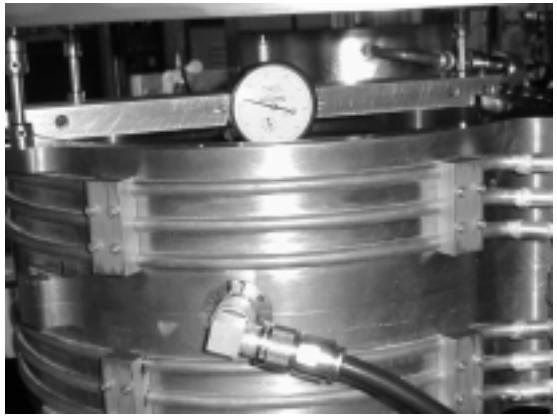


Cavity measurements

- Low-temperature tests in vacuum tank
  - ≈ 500 W RF input
  - LN_2 cooling







Cavity measurements

- Tune center cell to 890 MHz
  - Ring insert
  - Power amplifier bandwidth does not extend to 805 MHz
    - More contact resistance
    - Lower Q

- 350 W into center cell
  - No frequency change other than drift with temperature
    - Temperature changes due to boil-off of LN_2 in cooling tubes
    - Temperature of window not measured
  - No measured movement of foil

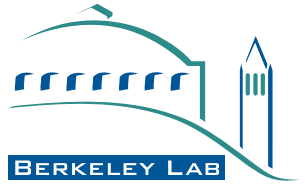
Cavity measurements

- Q low and non-reproducible
  - Replace spring contacts
  - Thorough cleaning of contact surfaces
- 500 W RF power in vacuum
  - 1 mTorr
  - Breakdown at feedthroughs
    - Vent connectors
    - Improve vacuum with cryopump
      - » $< 10^{-5}$ Torr
- Thermocouple contact to Be window at low temperature
  - Experiment with fixture
    - Cu tape?

Cavity measurements

- RF amplifier output reduced
  - DC psup fault
    - repair
- Q low, RF power dissipates in contact resistance not on windows
  - Use halogen lamp in vacuum tank
    - Thermal distribution similar to RF heating
    - Easily controlled
    - Maintain Be window frame at ≈ LN_2 temperature
- Be window not constrained radially
  - Remove spring contacts and clamp hard to Be frame to investigate differential contraction effects

Future measurements



- Vacuum tank next available for one week in December
- Prepare all equipment and procedures in advance

- Goals
  - Measure temperature rise of window vs. input power
    - RF or radiant heat
  - Measure window deflection vs temperature
  - Measure frequency change vs. deflection

- Extrapolate data to other designs
  - Can Be foils in RF structures maintain mechanical stability?